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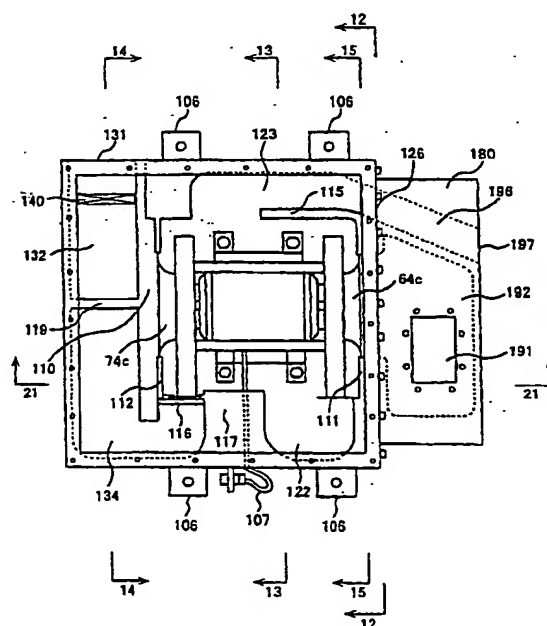
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(54) METHOD OF MANUFACTURING VENTILATING DEVICE AND THE VENTILATING DEVICE

(57) A ventilating device capable of being easily assembled and disassembled, wherein, after setting a blower for exhaust and a blower for air supply on an electric motor (55), the electric motor is installed in an exhaust flow path (122) of a silencer box (100), the inside of the silencer box (100) is divided by partitions into the exhaust flow paths (122, 123) and air supply flow paths (132, 134), sound absorbing material is installed on the wall surfaces of the air flow paths (122, 123, 132, and 134), each blower aligns with each of the air flow paths when an air blow device is inserted, and an opening into which the air blow device is inserted is covered by a cover (150), whereby the configuration of the ventilating device can be simplified and the assembly and disassembly operations can be made easily because the blowers can be assembled and disassembled from the side and the air blow devices can be inserted from the upper side.

Fig. 11



## Description

### FIELD OF THE INVENTION

[0001] This invention relates to a ventilating device for high-speed rolling stocks.

### PRIOR ART

[0002] The high-speed rolling stocks, represented by Shinkansen, are airtight structures, so that ventilating devices for permuting the air inside the car and the air outside the car are mounted at a predetermined rate. The ventilating device has the capability of ventilating while maintaining the pressure variation inside the car within a predetermined range, against the compression wave (positive pressure) during passing of tunnels, and the expansion wave (negative pressure).

[0003] This ventilating device is, as is disclosed in Gazette of Japanese Patent No. 2,685,521, provided with an exhaust fan and an air supply fan at both ends of an electric motor with its rotary shaft provided horizontally. Also, in order to cool the electric motor, the electric motor is covered by a case, and the exhaust air from the passenger car reaches the exhaust fan via the case.

### SUMMARY OF THE INVENTION

[0004] Generally, the ventilating device has its case for cooling the electric motor fixed to the end brackets of the electric motor. This makes the assembly operation of the ventilating device difficult.

[0005] Moreover, in order to maintain the predetermined capability of the ventilating device, it is necessary to remove (clean) the dust collected at the impellers of the blowers periodically, and to exchange the bearings of the electric motors. That is, disassembly operation for maintenance operation of the ventilating device becomes necessary. In this case, because the above-mentioned case is fixed to the end brackets of the electric motor, the disassembly operation was troublesome.

[0006] The object of the present invention is to simplify assembly operation and disassembly operation.

[0007] The above-mentioned object is accomplished by constituting a ventilating device from:

a ventilating blower installed inside an air flow path inside a box, including an electric motor with an rotary shaft provided in a horizontal direction;  
an opening provided to a surface in a vertical direction or in a horizontal direction of the box, for inserting the ventilating blower;  
a plate for covering the opening; and  
at least two openings for ventilation provided to a structure comprising the box and the lid.

[0008] The "two in number" of the openings in above-mentioned "two openings" is the case of equipping one

above-mentioned ventilating blower in one above-mentioned box. The ventilating blower in this case is either a blower for exhaust or a blower for air supply. When two air flow paths, that is, a blower for air supply and a blower for exhaust are equipped in one box, the number of the openings becomes four.

[0009] Also, there are cases when this opening is provided to above-mentioned plate, and an opening (covered by a plate) for inserting the ventilating blower could be used for at least one of the openings.

### BRIEF DESCRIPTION OF THE DRAWINGS

#### [0010]

FIG. 1 is a flowchart indicating the manufacturing process of a ventilating device according to one example of the present invention.

FIG. 2 is a front view of an electric motor rested on a pedestal.

FIG. 3 is a right side view of FIG. 2.

FIG. 4 is a front view of the electric motor in FIG. 2 installed with casings for blowers.

FIG. 5 is a right side view of FIG. 4.

FIG. 6 is a front view of the blower in FIG. 4 installed with impellers.

FIG. 7 is a right side view of FIG. 6.

FIG. 8 is a front view of the blower in FIG. 6 installed with suction pipes.

FIG. 9 is a right side view of FIG. 8.

FIG. 10 is a plane view of the ventilating device according to one example of the present invention.

FIG. 11 is a plane view of the ventilating device in FIG. 10 with lid taken off.

FIG. 12 is a cross-sectional view taken along line 12-12 in FIG. 11.

FIG. 13 is a cross-sectional view taken along line 13-13 in FIG. 11.

FIG. 14 is a cross-sectional view taken along line 14-14 in FIG. 11.

FIG. 15 is a cross-sectional view taken along line 15-15 in FIG. 11.

FIG. 16 is a cross-sectional view taken along line 16-16 in FIG. 15.

FIG. 17 is a cross-sectional view taken along line 17-17 in FIG. 15.

FIG. 18 is a cross-sectional view taken along line 18-18 in FIG. 15.

FIG. 19 is a longitudinal cross-sectional view of the lid in FIG. 10.

FIG. 20 is a cross-sectional view of the joint region of the silencer box and the lid in FIG. 10.

FIG. 21 is a cross-sectional view taken along line 21-21 in FIG. 11.

FIG. 22 is a plane view of the silencer box.

FIG. 23 is a horizontal cross-sectional view of the exhaust duct unit in FIG. 10.

FIG. 24 is a left side view of FIG. 23.

FIG. 25 is a right side view of another example of the blower.

FIG. 26 is a longitudinal cross-sectional view of another example of the ventilating device of the present invention in disassembled condition.

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0011] An example according to the present invention will now be described hereinafter with reference to FIG. 1 through FIG. 24. First, the outline of the manufacturing process of the ventilating device will be described with reference to FIG. 1.

[0012] An electric motor 55 is fixed to a pedestal 50 (step S10).

[0013] An exhaust casing 61 and an air supply casing 71 of a blower are mounted to both sides of the electric motor 55 fixed to the pedestal 50 (step S20).

[0014] Impellers 63, 73 are respectively mounted to both shaft ends of the electric motor 55 (step S30).

[0015] A suction pipe for exhaust 64c and a suction pipe for air supply 74c are respectively mounted to the exhaust casing 61 and the air supply casing 71 (step S40).

[0016] The unit manufactured in the process of the above-mentioned step S10 through step S40 is called an air blow device.

[0017] The above-mentioned air blow device is mounted to the interior of a silencer box 100 with built-in air supply flow path and exhaust flow path. The air blow device is electrically wired. Also, the opening through which the air blow device was inserted is closed by a lid 150. After carrying out other final operations, the process is completed (step S50).

[0018] Next, the structures of various parts for the above-mentioned manufacturing steps will be described.

[0019] Step S10: The electric motor 55 of the both shaft type is attached onto the pedestal 50 by screws, in FIG. 2 and FIG. 3. The shaft of the electric motor 55 is provided in the horizontal direction. The pedestal 50 is constituted by combining a flat plate and channel materials. When seen from above, the end portions of the pedestal 50 project further than the electric motor 55. With such configuration, the pedestal 50 could be inserted into the silencer box 100 and then attached thereto with screws from above. The pedestal 50 includes screw holes or nuts, and the electric motor includes holes for passing the screws through. The attaching portions of the screws mentioned later have screw holes on one of the members, and holes on the other.

[0020] Step S20: The casing 61 for blower for exhaust, and the air supply casing 71 are respectively installed to both ends of the electric motor 55, in FIG. 4 and FIG. 5. The blower is a multiblade fan.

[0021] First, the lower portions of the casings 61, 71 of the blower are fixed to the pedestal 50. In casings 61,

71, there exist brackets 65, 66, 75, 76 to the plate on the side of the electric motor 55. The brackets 65, 75 are attached to the upper surface of the pedestal 50 by screws from above.

5 [0022] Next, the casings 61, 71 are attached to end brackets of the electric motor 55 with screws via cushionings 68, 78. The plates of casings 61, 71 on the side of the electric motor 55 are attached. This attachment is performed through an opening 61b (opening 71b is not shown) for inserting impeller of the casings 61, 71. Air outlets 62, 72 of the casings 61, 71 are equipped with flanges 62b, 72b projecting abroad. The flange 72b is especially necessary.

10 [0023] Next, the upper brackets 66, 76 of the casings 61, 71 are connected together from above by a rigid connecting member 67. The connection is performed by attaching with screws from above.

15 [0024] Step S30: The impellers 63, 73 are mounted to both shaft ends of the electric motor 55, in FIG. 6 and FIG. 7. The mounting is performed from the opening 61b on the suction hole side of the casings 61, 71. The opening 61b is larger than the outer diameter of the impellers 71, 72.

20 [0025] Step S40: Members 64, 74 for the suction holes are mounted to the plates on the suction hole side of the casings 61, 71, in FIG. 8 and FIG. 9. To explain the member 64 of the suction hole, it is comprised of a flange 64b for covering the opening 61b, and a suction pipe 64c. Flange 64b is attached to the casing 61 with screws. The suction pipe 64c is expanded at the suction side. The same applies to member 74.

25 [0026] Step S50: It will be explained with reference to FIG. 10 through FIG. 24. The unit obtained in step S40 will be called the air blow device. This air blow device is inserted through the opening at the upper surface of the silencer box 100, and is fixed thereto. Also, the electric motor 55 is performed with wiring operation, and the opening is covered by the lid 150. Also, the connection of the exhaust duct unit 180 is conducted.

30 [0027] In FIG. 10, the ventilating device is comprised of the silencer box 100 with the air blow device stored therein, and the exhaust duct unit 180. An outlet 136 for air supply flow path is provided at the upper surface of the silencer box 100. An inlet 131 for air supply flow path is provided at the rear surface of the silencer box 100. The exhaust duct unit 180 is fixed to the right side surface of the silencer box 100. An inlet 191 for exhaust flow path is provided at upper surface of the exhaust duct unit 150. The openings 136, 191 are connected to a passenger car of the car body through the ducts. Screw holes for connecting with the duct at the car body side are provided to peripheries of the openings 136, 191. An outlet 196 for exhaust flow path is provided at the right side surface of the exhaust duct unit 180. Reference number 106 denotes a pedestal for suspending from the car body.

35 [0028] In FIG. 11 through FIG. 22, the silencer box 100 is comprised of a silencer box and a lid 150. The lid

150 closes the upper surface of the silencer box 100. The lid 150 is attached to the upper portion of the silencer box 100 with screws.

[0029] The silencer box 100 is a square box made of metal. The silencer box includes a bottom, but is opened at the upper surface thereof. The exhaust flow path and the air supply flow path are constituted by partitioning the box with partitions. The silencer box 100 is provided with inlets 121, 131 and outlets 126, 136 for respective air flow paths. The inlet 121 and the outlet 126 of the exhaust flow path are opened at the plate of the right side surface of the silencer box 100. The inlet 131 of the air supply flow path is opened at the rear surface, and the outlet 136 is opened at the upper surface, that is, at the lid 150. The upper surface of the lid 150 is a plate made of metal. The left side of the silencer box 100 is the air supply flow path, and the right side thereof is the exhaust flow path.

[0030] The exhaust flow path is comprised of a flow path 122 running from the front surface side of the silencer box 100 to the rear surface side, and a flow path 123 running along the rear surface. The air from the blower for exhaust is ejected to the front surface side. The flow path 122 and the flow path 123 are partitioned by a partition 115. The opening from the flow path 122 to the flow path 123 is provided to the lower portion of the silencer box 110. The flow path 123 is connected to the outlet 126.

[0031] The exhaust flow path and the air supply flow path are parted to left and right by the partition 110. The partition 110 extends from the vicinity of the front surface side to the plate of the rear surface. The partition 110 is provided with an opening 133 for the entrance to the blower for air supply. Partitions 116, 117 are provided between the front surface side of the partition 110 and the plate of the front surface. The plate 116 is provided with an opening opposing the outlet 72 of the blower for air supply. The partition 117 partitions the inner portion of the front surface side to left and right. The air supply flow path is partitioned to a flow path 132 of the inlet side and a flow path 134 of the outlet side with a partition 119.

[0032] The wall surfaces constituting the exhaust flow path and the air supply flow path, that is, the inner surface of the plates of the silencer box 100, the partitions 110, 115, 116, 117, 119 and the like, and the inner surface of the plates of the lid 150, are affixed with sound absorbing materials 108 to constitute the silencer. The corner portions of the air flow paths are formed in arcuate shape. The outer surface of the sound absorbing material is suitably covered with punching metals.

[0033] The silencer box 100 is provided with a bottom, and a pedestal 105 for resting the pedestal 50 is provided to the upper surface of the bottom plate. The lower portion of the electric motor 55 is installed with the sound absorbing material 108c. The casings 61, 71 are positioned to both sides of the pedestal 105.

[0034] The lid 150 is rested on a depressed flange at the upper surface of the silencer box 100, and is at-

tached thereto from above with screws.

[0035] The assembly process will be described. First, the air blow device obtained in S40 is inserted into the silencer box 100 without the lid 150, and is rested on the pedestal 105. The end portions of a base 50 are attached to the pedestal 105 from above with screws. The air blow device has its rotary shaft positioned in left and right directions. The outlets 62, 72 of the respective blowers are facing the front surface side. It is preferable to rest the air blow device through a vibration-proof rubber. Next, a wire 107 is connected to a terminal base of the electric motor 55. The wire 107 is pierced through the silencer box 100 in advance.

[0036] When the air blow device is inserted to the silencer box 100, the leading ends of the suction pipes 64c, 74c engage with the partitions 111, 112 provided with semicircular recessed portions. The partition 111 is installed at the inner surface of the plate at the right side surface of the silencer box (blower side). The partition 112 is installed at the partition 110. The partition 112 is positioned more toward the blower side than the partition 110.

[0037] To describe the partition 111, the cross-section of the semicircular recessed portion includes a U-shaped groove. The groove is arranged with cross-sectionally U-shaped cushioning 113. The leading end of the suction pipe 64c comes into contact with the cushioning 113. The partition 111 above the semicircular recessed portion is expanded in a trapezoid shape. A cross-sectionally U-shaped cushioning 113b is arranged to the trapezoid portion. The same applies to the partition 112.

[0038] Next, the lid 150 is attached to the silencer box 100 from above with screws. The lower surface of the lid 150 is arranged with the sound absorbing materials opposing the flow paths 122, 123, 132, 134 and the like. To the areas opposing the partitions 110, 115, 116, 117 and the like, the cushionings are arranged in order to prevent air leakage.

[0039] Partitions 161, 162 for closing the openings of the partitions 111, 112 are suspended from the lower surface of the lid 150. To describe the partition 161, the lower end of the partition 161 is formed in a semicircular recessed portion coming into contact with the semicircular portion of the upper portion of the suction pipe 64c. The recessed portion is provided with a U-shaped groove. The groove is arranged with a U-shaped cushioning 113. The leading end of the suction pipe 64c comes into contact with the cushioning 113. Also, both sides of the recessed semicircular portion 121b are expanded in trapezoid shape in conformity with the partition 111. The trapezoid portion comes into contact with the cushioning 113b. The same applies to the partition 162.

[0040] The position in the silencer box 100 where the air blow device is inserted is in the exhaust flow path 122. The electric motor 55, the blower for exhaust, and the blower for air supply are all positioned in the exhaust

flow path 120. The outlet 62 of the blower for exhaust is positioned in the exhaust flow path 122.

[0041] The flange 72b of the opening 72 of the blower for air supply comes into contact with the partition 116 partitioning the exhaust flow path 120 and the air supply flow path 130. The cushioning is arranged between the two. To make sure that the flange 72b comes into contact with the partition 116, the air blow device is forced against the front surface side of the silencer box 100, and the base 50 is attached to the pedestal 105.

[0042] Next, the exhaust duct unit 180 is fixed to the plate at the right side surface of the silencer box 100 with screws.

[0043] In FIG. 11, FIG. 23 and FIG. 24, the exhaust duct unit 180 is a square box, with six sides thereof covered with plates. A flange for mounting is provided to the outer periphery at the left end. The exhaust duct unit 180 includes a suction flow path 192 and an exhaust flow path 196. An inlet 191 of the suction flow path 192 is opened at the upper surface. An outlet 197 of the exhaust flow path 196 is opened at the right side surface. An outlet 193 of the suction flow path 192 and the inlet 195 of the exhaust flow path 196 are opened at the left side surface. The outlet 193 opposes the suction pipe 64c of the exhaust blower.

[0044] The outlet 193 comes into contact with partitions 111, 161 via cushionings. The inlet 195 of the exhaust flow path 196 opposes the outlet 123 of the exhaust flow path. The inlet 195 comes into contact with the plate of the right side surface of the silencer box via the cushioning. Therefore, the outlet 193 projects more towards the silencer box 100 side than the inlet 195.

[0045] The sound absorbing material is installed to the wall surfaces of the air flow paths 192, 196 of the exhaust duct unit 180. The sound absorbing materials are installed to the plates for six surfaces of the exhaust duct unit 180, and to the partition for partitioning the flow path 192 and the flow path 196. After arranging the sound absorbing material to the interior, the plate for one of the surfaces is fixed to constitute the exhaust duct unit 180.

[0046] The exhaust air from the inlet 191 reaches the blower for exhaust through the flow path 192 and the suction pipe 64c. The exhaust air is boosted at this point, and is discharged to the front surface side of the flow path 122. The electric motor 55 is placed in the flow path 122, so that the exhaust air cools the electric motor 55. Then, it is ejected to the exterior via the flow paths 123, 196.

[0047] The fresh air entering from the inlet 131 reaches the blower for air supply from the suction pipe 74c via a flow path resistor 140 and the flow path 132. The fresh air is boosted at this point, and is discharged to the front surface side of the flow path 134, and reaches the outlet 136 via the flow path 134. The flow path resistor 140 changes the opening rate of the air flow path. By changing the opening rate, the amount of air entering the car is determined, and the pressure inside the car is

set at a predetermined amount. The setting of the opening rate is performed from the inlet 131.

[0048] With such structure, the assembly of the air blow device could all be performed from above or from the side. Also, it could be assembled by inserting the air blow device to the silencer box 100 from above. Therefore, the assembly could be performed with ease.

[0049] Also, the above-mentioned box is arranged with sound absorbing material to constitute a silencer, therefore noise could be reduced.

[0050] Moreover, disassembling for the purpose of maintenance operation could be performed by removing the ventilating device from the car body, and then removing the lid 150 and pulling out the air blow device upwardly.

[0051] Next, after placing the air blow device horizontally, the members 64, 74 of the suction holes are removed, and the cleaning of the impellers 63, 73 are carried out. This cleaning could be performed by removing the impellers 63, 73 from the shaft. Also, the exchange of the bearings could be performed by removing the casings 61, 71 from the end brackets of the electric motor 55, and then removing the end brackets.

[0052] As is seen from above, the maintenance operation could be carried out with ease, because there is no need to turn the heavy air blow device upside down.

[0053] The silencer box 100 contains two blowers for air supply and exhaust, therefore four openings must be present. However, this opening could serve both as the opening for inserting the air blow device. In the above-mentioned embodiment, the outlet 136 of the air supply flow path serves both as the opening for inserting the air blow device, and is provided at the lid 150. Also, the outlet 126 of the exhaust flow path could be installed at the lid 150. As is seen from above, the silencer box 100 should have four openings for air supply and exhaust as a result, and there is no need to have four openings in the box before being covered by the lid 150.

[0054] The blower rotates at high speed. Therefore, there is a fear that the casings of the blower might vibrate. By fixing the lower portions of the casings 61, 71 to the pedestal 50, and fixing the upper portions of the casings 61, 71 together with plurality of connecting members 67, rigidity could be improved, and vibration could be restrained.

[0055] It could also be constituted by providing an opening for inserting the air blow device to the inner side of the lid 150, and covering the opening with a second lid. The partitions 161, 162 are installed on the second lid. By doing so, it becomes easier to align the partitions 161, 162 with partitions 111, 112.

[0056] The relation between the outlet 72 of the blower for air supply and the partition 116 may be made the same as the relation between the suction pipe 64c (74c) and the partitions 111, 161 (112, 162).

[0057] Also, the flange 72b of the outlet 72 may be formed slightly downwardly, and the partition 116 may be formed slightly upwardly, and the two may be con-

nected via the cushioning.

[0058] Moreover, the partitions 112, 162 may not be necessary. The inlet 133 is opened on the partition 110. The flange of the suction hole of the suction tube 74c comes into contact with the partition 110 via the cushioning. This contact is performed by pushing the electric motor 55 towards the partition 110 side. Further, in the case with the structure where the flange 72b of the outlet 72 of the blower for exhaust contacts the partition 116, the electric motor 55 is pushed towards the left side and the front surface side.

[0059] The partitions 111, 161 may not be necessary. The inlet 121 is opened at the plate of the right side surface of the silencer box 100. The member of the outlet 193 of the exhaust duct unit 180 comes into contact with the flange of the suction pipe 64c via the cushioning. This contact is performed by fixing the exhaust duct unit 180 to the silencer box 100. When the outlet 193 is projected, the thickness of the cushioning may be thinned.

[0060] As is the case with the exhaust duct unit 180, the unit including the flow paths 132, 134 may be made in a different unit from the silencer box 100.

[0061] The example according to FIG. 25 will be described. The electric motor 55 is provided inside the air flow path to keep cool. Therefore, it is preferable to form the connecting member 67b in an arcuate shape along the housing of the electric motor 55, so that the air flows along the electric motor 55. The sound absorbing material 108b (shown in FIG. 19) of the lid 150 is arranged adjacent to the upper surface of the front surface side of the connecting member 67b. With such arrangement, the amount of air flowing along the upper surface of the connecting member 67b could be made smaller, and the amount of air towards the electric motor 55 side could be made larger, enabling effective cooling. The width of the sound absorbing material 108b is about the length between the casings 61 and 71.

[0062] Air could be discharged directly from the silencer box 100 directly to the atmosphere, excluding the flow path 196 of the exhaust duct unit 180. Also, as the air supply flow path is provided inside the silencer box 100, the flow paths 192, 196 of the exhaust duct unit may be provided inside the silencer box 100.

[0063] The above-mentioned example is the case where a blower is provided respectively to both shaft ends of one electric motor. However, the same could be applied to the case of two electric motors, with one blower provided to each of the electric motors.

[0064] Equipment for controlling the electric motor 55, such as an inverter and the like, may be installed to the air flow path to cool. For example, it is installed to the lid 150.

[0065] The example according to FIG. 26 will be described. This is a longitudinal cross-sectional view of the condition where the air blow device is pulled out downwardly. This example is the case where the opening for inserting the air blow device is provided to the lower surface of the silencer box 200. The other structures are

the same as the above-mentioned example, except that the exhaust duct unit 180 connected to the right side surface is not shown. In the case of a maintenance operation, the exhaust duct unit 180 is removed, and then the air blow device is pulled out downwardly. The silencer box 200 remains mounted to the car body 250.

[0066] The pedestal 50 of the air blow device is installed to the plate (lid) 210 for covering the opening at the lower surface of the silencer box 200. The plate 210 is constituted firmly. The plate 210 is fixed to the silencer box 200.

[0067] The air blow device is moved vertically in the above-mentioned example, but it may be stored by moving the same horizontally. When the direction of movement is in the direction of the shaft, the connection between the suction hole and the outlet of the blower could be made simple. In this case, it is preferable to face the outlet of the blower slightly towards the direction of movement. Also, it is preferable to construct so that the electric motor moves along a rail.

[0068] The above-mentioned example is a combination of two blowers in one electric motor and one silencer box. However, it may be formed in a combination of one blower and one silencer box. In this case, there should be two openings for ventilation to one silencer box as a result. In the case of inserting from the horizontal direction, the blower should be inserted by providing the outlet of the blower to face the direction of insertion (rear surface side), so that the outlet of the blower comes into contact with the partition.

[0069] The technical scope of the present invention is not limited to the terms used in the claims or in the summary of the present invention, but is extended to the range in which a person skilled in the art could easily substitute based on the present disclosure.

[0070] According to the present invention, the assembly operation and the disassembly operation could be performed with ease.

## Claims

1. A method of manufacturing a ventilating device, the method comprising:

inserting a ventilating blower including an electric motor to an air flow path of a box with the ability to include at least two openings as a result for ventilation, in a vertical direction or in a horizontal direction; and  
fixing said ventilating blower to said box with a rotary shaft thereof arranged in a horizontal direction, as well as covering said opening for insertion with a plate.

2. A method of manufacturing a ventilating device according to claim 1, comprising:

inserting said ventilating blower from above said box, and fixing the same from above; and covering said opening at upper surface of said box through which said ventilating blower is inserted with said plate.

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3. A method of manufacturing a ventilating device according to claim 1, comprising:

inserting said ventilating blower from a lower surface of said box, in a condition where said ventilating blower is rested on top of said plate.

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4. A method of manufacturing a ventilating device according to claim 1, comprising:

inserting said ventilating blower from the horizontal direction of the shaft direction of the rotary shaft.

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5. A method of manufacturing a ventilating device according to claim 1, comprising:

providing said box at wall surfaces of said air flow paths in advance with sound absorbing materials.

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6. A method of manufacturing a ventilating device according to claim 1, comprising:

installing said ventilating blower with a blower for exhaust and a blower for air supply at each ends of one electric motor; and performing said insertion to place said electric motor in one of said air flow paths.

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7. A method of manufacturing a ventilating device according to claim 1, comprising:

mounting a duct to a side surface of said box after mounting said ventilating blower to said box, and at this point, contacting an air flow path of said duct to a suction hole of a suction pipe of said ventilating blower.

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8. A method of manufacturing a ventilating device according to claim 7, with said duct being equipped with two air flow paths, the step comprising:

contacting one of said air flow path with a suction hole of a suction pipe of said ventilating blower, and contacting the other of said air flow path with an air flow path from said blower, when mounting said duct to said box.

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9. A method of manufacturing a ventilating device according to claim 1, with said ventilating blower including a blower for exhaust and a blower for air supply to each ends of one electric motor, the step comprising:

fixing said ventilating blower by contacting a suction hole of one of said blowers with a par-

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tion inside said box; and subsequently mounting a duct to a side surface of said box, and at this time, contacting an air flow path of said duct with a suction hole of a suction pipe of said ventilating blower.

10. A method of manufacturing a ventilating device according to claim 1, comprising:

inserting said ventilating blower with an outlet facing the direction of insertion; mounting said ventilating blower to said box; and mounting a duct to a side surface of said box, and at this time, contacting an air flow path of said duct to a suction hole of a suction pipe of said ventilating blower.

11. A ventilating device, comprising:

a ventilating blower installed inside an air flow path inside a box, including an electric motor with an rotary shaft provided in a horizontal direction; an opening provided to a surface in a vertical direction or in a horizontal direction of said box, for inserting said ventilating blower; a plate for covering said opening; and at least two openings for ventilation provided to a structure comprising said box and said lid.

12. A ventilating device according to claim 11, wherein said opening for inserting said ventilating blower is provided to an upper surface of said box; and said plate is placed on an upper surface of said box.

13. A ventilating device according to claim 11, wherein said opening for inserting said ventilating blower is provided to a lower surface of said box; and said plate is positioned at a lower surface of said box, and is resting said electric motor on top thereof.

14. A ventilating device according to claim 11, wherein said opening and said plate is provided to a surface in the shaft direction of said rotary shaft of said ventilating blower.

15. A ventilating device according to claim 11, wherein sound absorbing materials are arranged to wall surfaces constituting said air flow paths inside said box.

16. A ventilating device according to claim 11, wherein a duct is mounted to a side surface of said box; and an air flow path of said duct comes into contact with a suction hole of said ventilating blower.

17. A ventilating device according to claim 16, wherein said duct is two in number;

one of said duct is mounted to one side surface of said box; and  
the other said duct is mounted to another side surface opposing said one side surface.

18. A ventilating device according to claim 11, wherein a duct including two air flow paths is mounted to a side surface of said box;

a downstream end of one said air flow path comes into contact with said suction hole of said ventilating blower; and  
another said air flow path comes into contact with another said opening on a side surface of said box.

19. A ventilating device according to claim 11, wherein casings of said ventilating blower are fixed to end brackets of said electric motor; and

members of air suction holes of said ventilating blower are larger in diameter than impellers of said ventilating blower, and are provided detachably to said casings.

20. A ventilating device according to claim 11, wherein said ventilating blower includes a blower for exhaust and a blower for air supply to each end of one electric motor; and

said electric motor is installed in one of said air flow paths.

21. A ventilating device according to claim 11, wherein said ventilating blower includes a blower for exhaust and a blower for air supply to each end of one electric motor;

a suction hole of one blower is in contact with a partition inside said box; and  
a suction hole of the other blower is in contact with an air flow path of a duct installed to a side surface of said box.

22. A ventilating device according to claim 11, wherein each

said blowers includes suction pipes projecting in horizontal directions;  
said box below at least one said suction pipe includes a semicircular partition contacting the lower surface of said suction pipe; and  
said plate includes a semicircular partition contacting the upper surface of said suction pipe, opposing said semicircular partition.

23. A ventilating device according to claim 11, wherein

said ventilating blower includes a blower for exhaust and a blower for air supply to each end of one electric motor;

casings of said respective blowers are fixed to end brackets of said electric motor; and  
one said casing and the other said casing are connected with a rigid body.

24. A ventilating device according to claim 23, wherein lower portions of said each casings are fixed to a pedestal for resting said electric motor.

25. A ventilating device according to claim 23, wherein said rigid body is provided continuously along said electric motor.

#### Amended claims under Art. 19.1 PCT

1. (Amended) A method of manufacturing a ventilating device, the method comprising:

inserting an air blow device including a blower for air supply to one end side of a rotary shaft of an electric motor of both shaft type, and an exhaust blower to another end side thereof, to an air flow path of a box with the ability to include at least four openings as a result for ventilation, in a vertical direction or in a horizontal direction;  
fixing said air blow device to said box with said rotary shaft provided in a horizontal direction; and  
covering said opening for insertion with a lid.

2. (Amended) A method of manufacturing a ventilating device according to claim 1, comprising:

inserting said air blow device from an opening at an upper surface of said box, and fixing the same from above; and  
subsequently covering said opening of said box through which said air blow device is inserted with said lid.

3. (Amended) A method of manufacturing a ventilating device according to claim 1, comprising:

inserting said air blow device relatively in said vertical direction, in a condition where said air blow device is rested on top of said lid.

4. (Amended) A method of manufacturing a ventilating device according to claim 1, comprising:

inserting said air blow device from the horizontal direction of the shaft direction of said rotary shaft.



5. (Amended) A ventilating device, comprising:

a box including an opening on one of the surfaces;  
 a lid being fixed to said box for closing said opening;  
 a structure comprising said box and said lid constituting at least first air flow path to its interior;  
 said structure including an inlet and an outlet for said first air flow path, and including an inlet and an outlet for said second air flow path;  
 an electric motor of both shaft type being fixed to the lower surface of said first air flow path inside said first air flow path, with a rotary shaft thereof provided in a horizontal direction;  
 a first blower for air supply or exhaust being installed to one end side of said electric motor, with a suction hole opened to one side surface of said box, and an outlet opened inside said first air flow path; and  
 a second blower for exhaust or air supply being installed to the other end side of said electric motor, with a suction hole opened to other side surface of said box, and an outlet opened to a partition constituting said first air flow path.

6. (Amended) A ventilating device according to claim 5, wherein said lid is positioned to the upper surface of said box; and

said electric motor is rested on a bottom surface of said box.

7. (Amended) A ventilating device according to claim 5, wherein said lid is positioned to the lower surface of said lid; and

said electric motor is rested on said lid.

8. (Amended) A ventilating device according to claim 5, wherein said lid is positioned to a side surface of said box;

said electric motor is rested on a bottom surface of said box; and  
 said lid is in contact with a member of said suction hole of either said first blower or said second blower.

9. (Amended) A ventilating device according to claim 5, wherein casings of said first blower and said second blower are respectively fixed to end brackets of said electric motor;

openings of said casings at said suction hole side are larger in diameter than that of impellers of said blower; and  
 each members of said suction holes are installed detachably to said casings.

10. (Amended) A ventilating device according to claim 5, wherein members constituting suction holes of each said blowers includes suction pipes thereof projecting in a horizontal directions;

said box below at least one said suction pipe includes a semicircular partition contacting the lower surface of said suction pipe; and  
 said lid is provided with a semicircular partition contacting the upper surface of said suction pipe, opposing said semicircular partition.

11. (Amended) A ventilating device according to claim 5, wherein said casing of said first blower and said casing of said second blower are connected by a rigid body.

12. (Amended) A ventilating device according to claim 11, wherein lower portions of said both casings are fixed to a pedestal for resting said electric motor.

13. (Amended) A ventilating device according to claim 5, wherein said first air flow path is constituted so as to reach said outlet of said first air flow path via an opposite position from said outlet of said first blower.

14. (Amended) A ventilating device according to claim 13, wherein said casing of said first blower and said casing of said second blower are connected by a rigid body; and

said rigid body exists continuously so as to constitute an air flow path between an outer surface of said electric motor.

15. A ventilating device according to claim 5, wherein said structure constitutes a second air flow path and a third air flow path;

said suction hole of said second blower is opened to said second air flow path; and  
 said outlet of said second blower is opened to said third air flow path.

16. A ventilating device according to claim 15, wherein a hole connecting to said third air flow path is provided to said lid.

17. A ventilating device according to claim 5, wherein said outlet of said first blower and said outlet of said second blower are located towards identical radial direction of said rotary shaft.

18. (Deleted)

19. (Deleted)

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22. (Deleted)

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Fig. 1

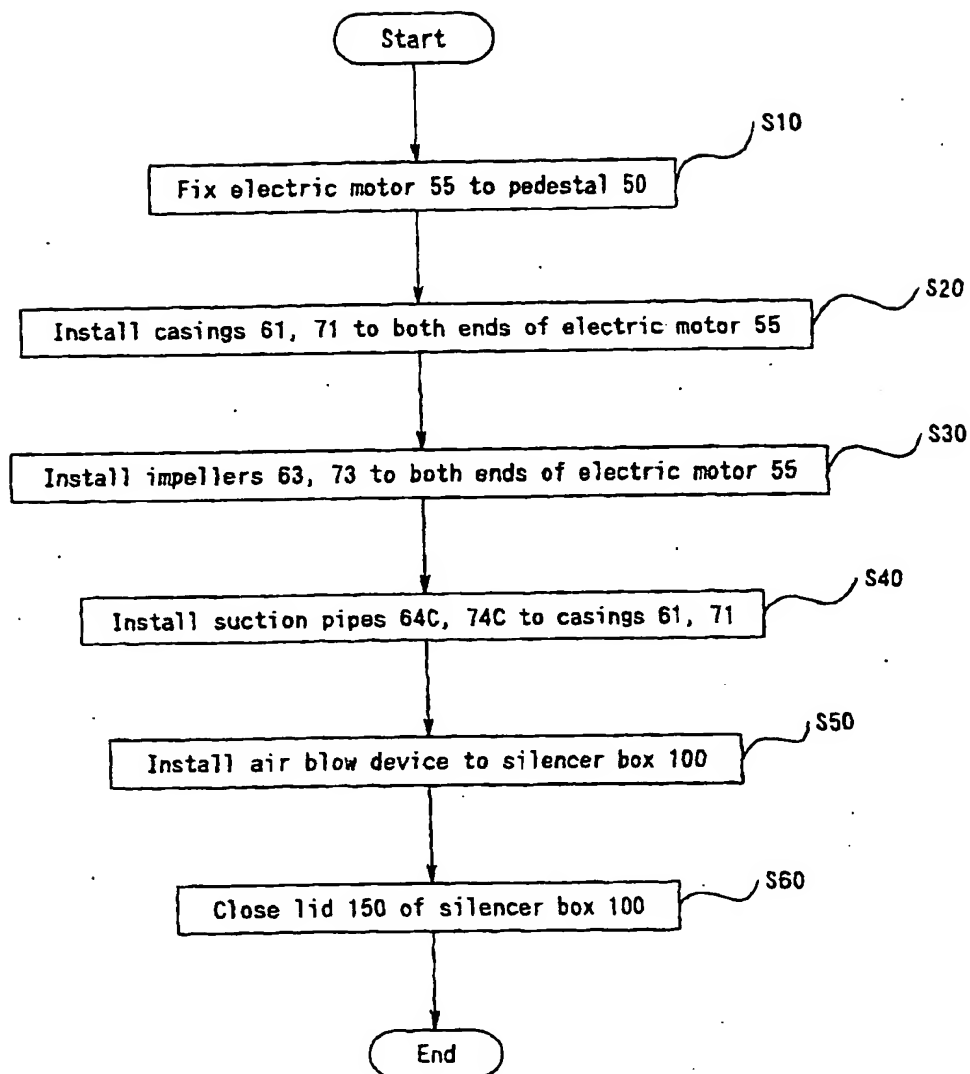


Fig. 2

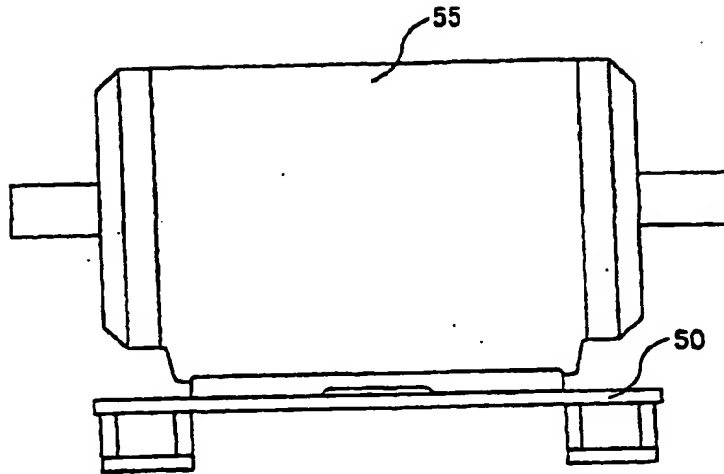


Fig. 3

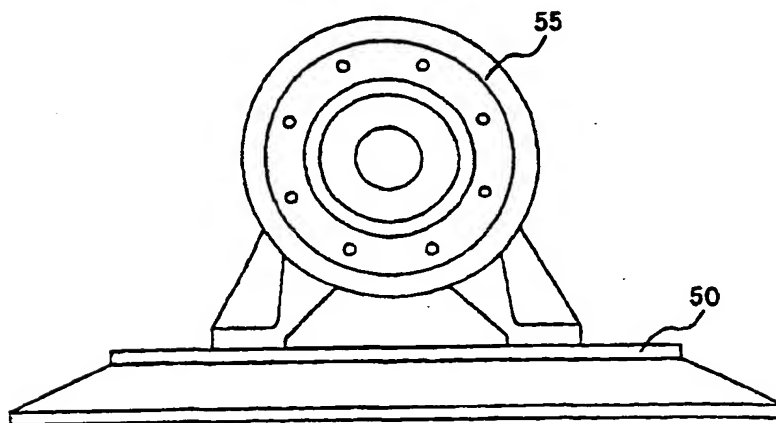


Fig. 4

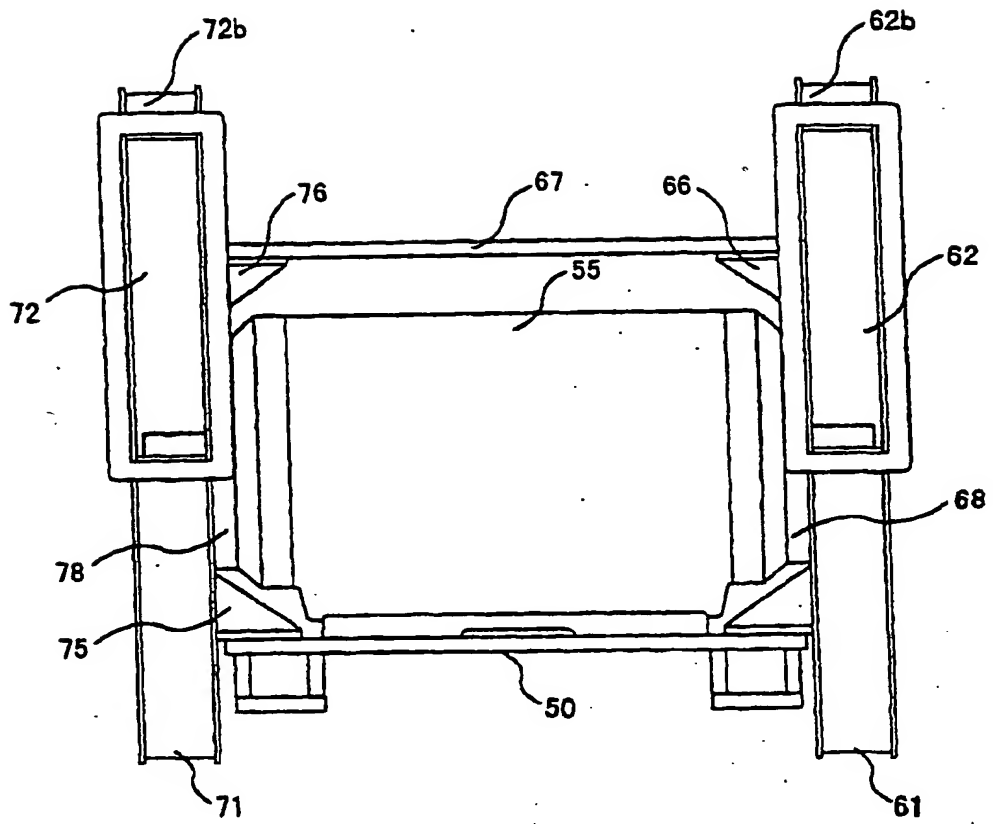


Fig. 5

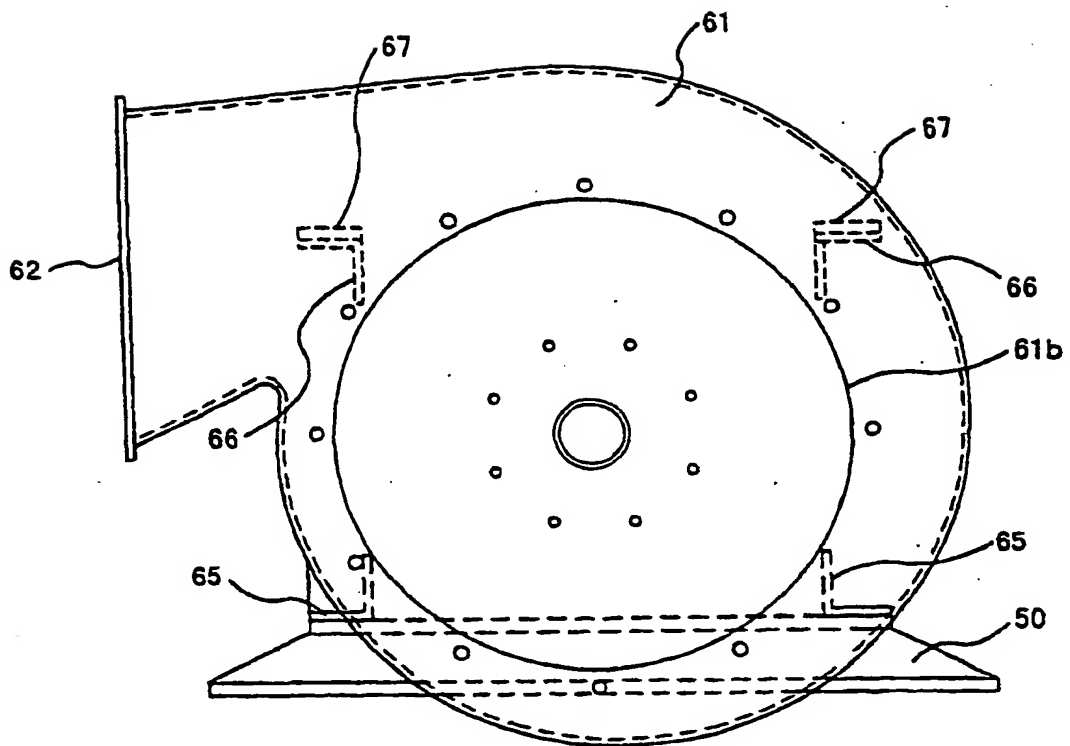


Fig. 6

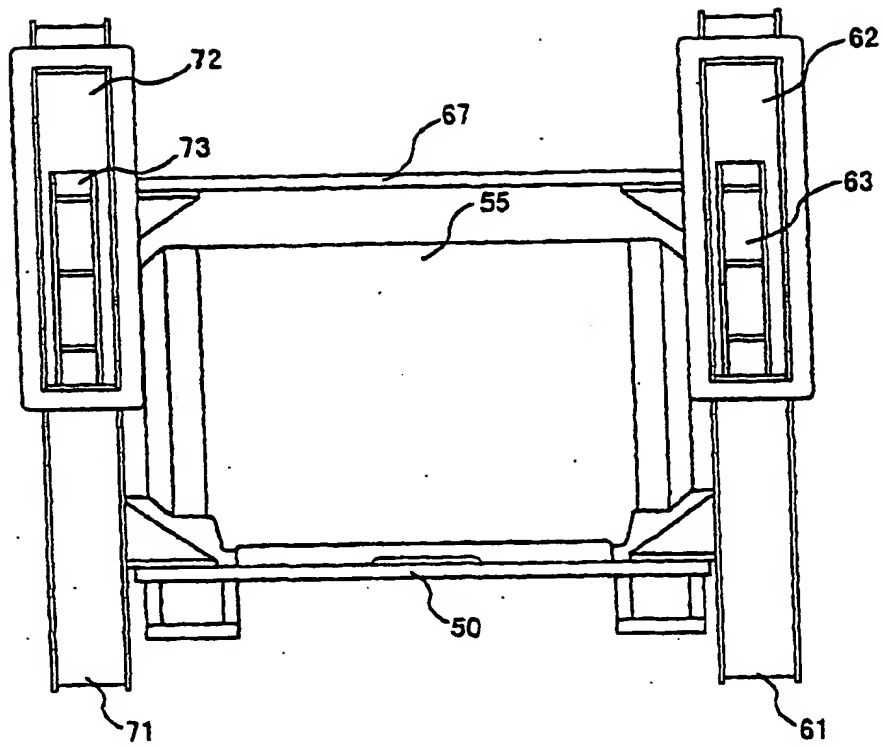


Fig. 7

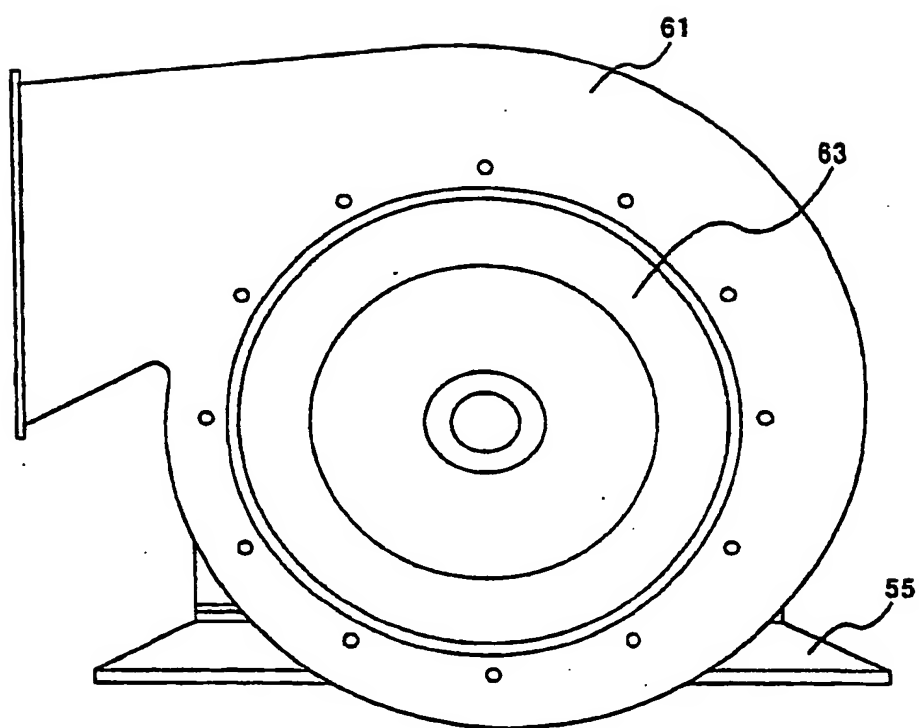




Fig. 8

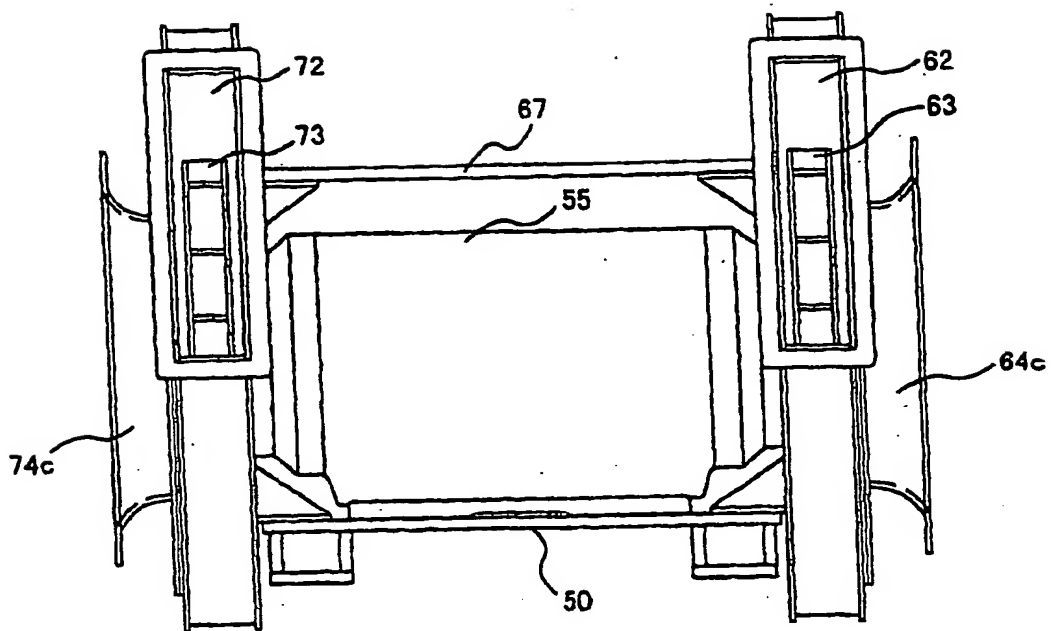


Fig. 9

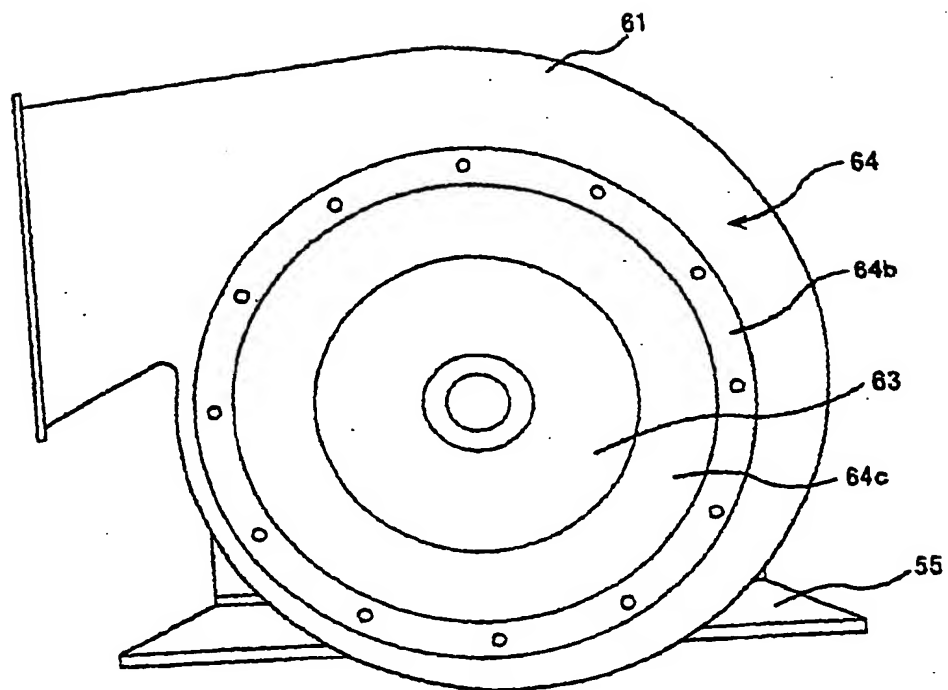


Fig. 10

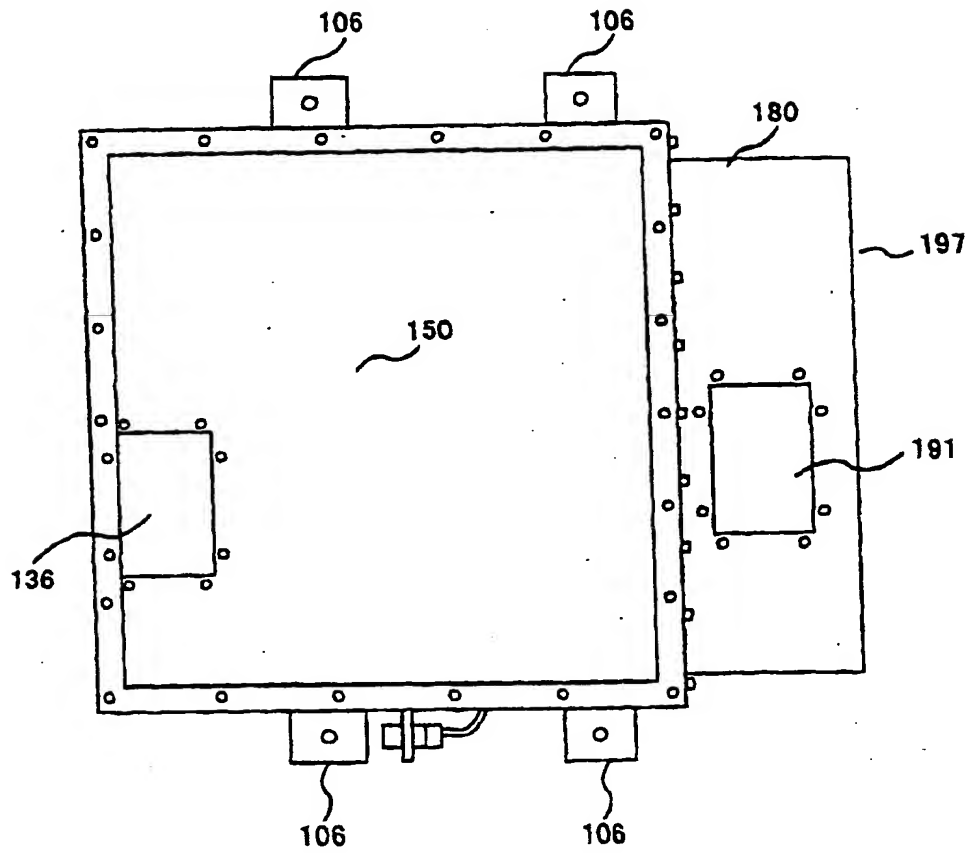


Fig. 11

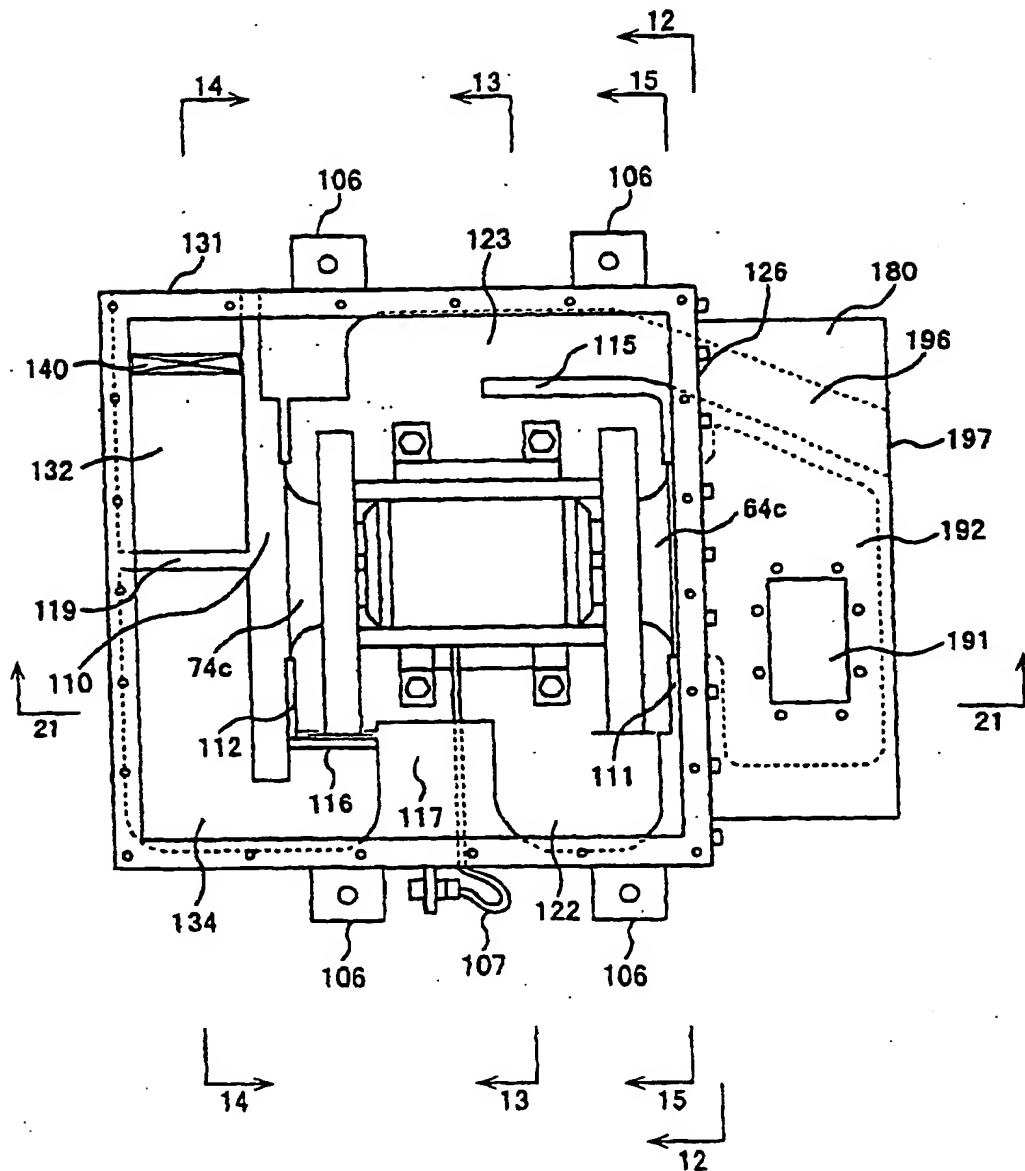


Fig. 12

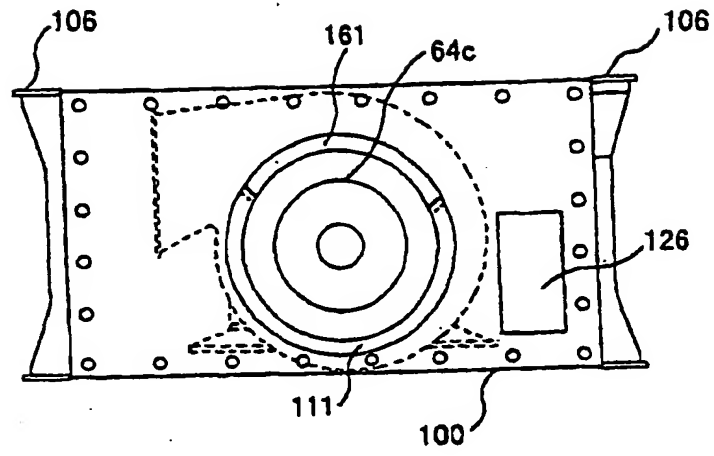


Fig. 13

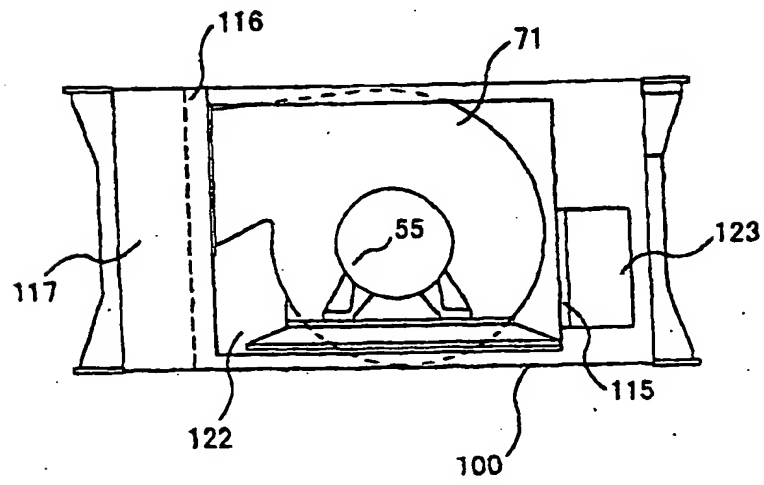


Fig. 14

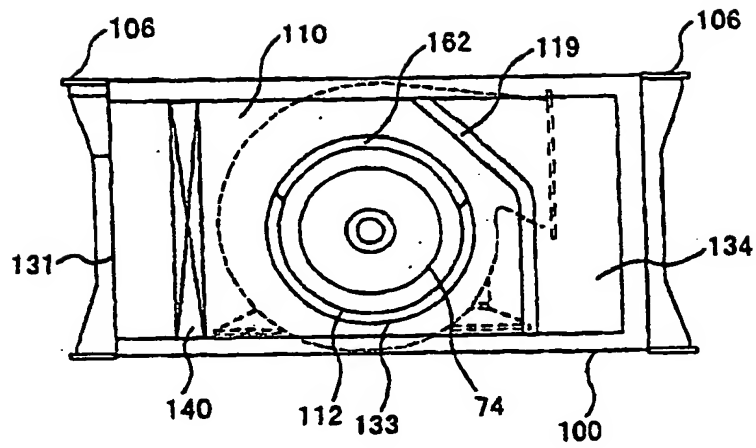


Fig. 15

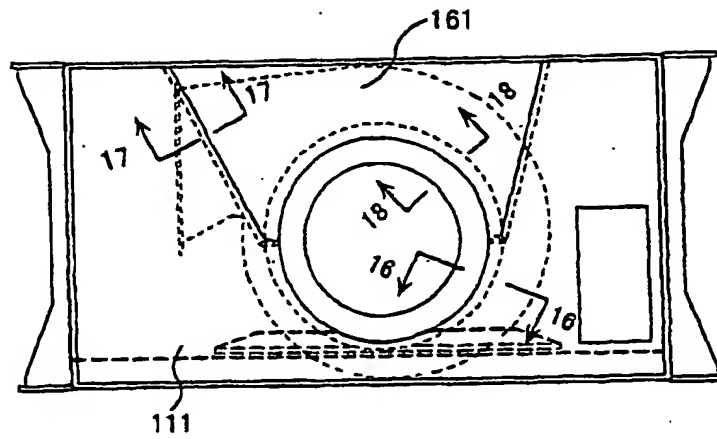


Fig. 16

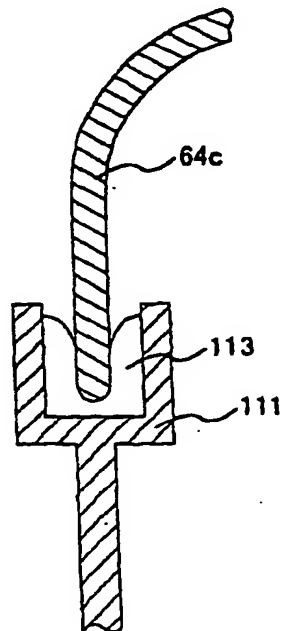


Fig. 17

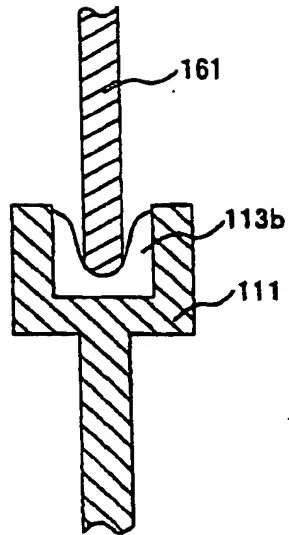




Fig. 18

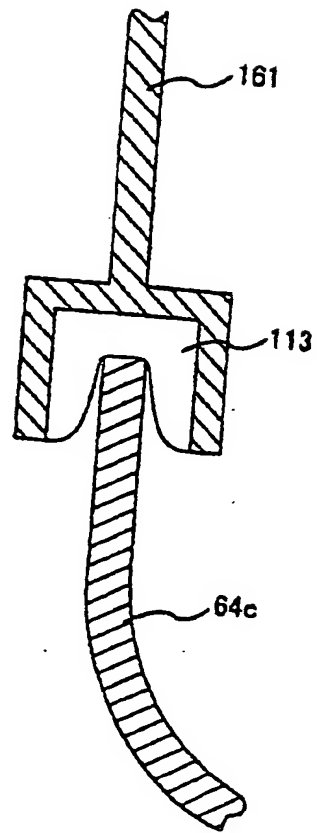


Fig. 19

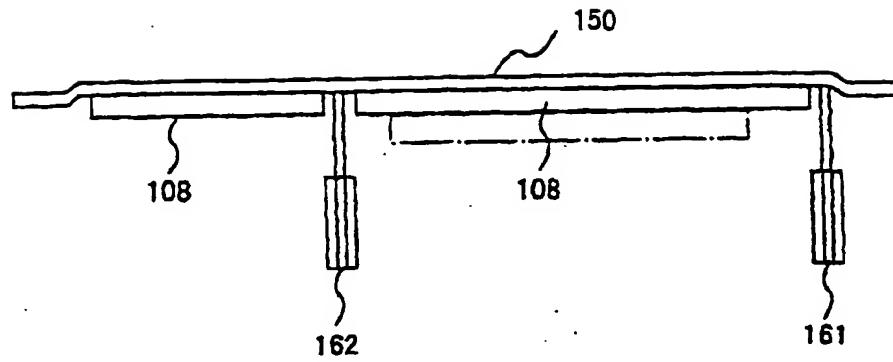


Fig. 20

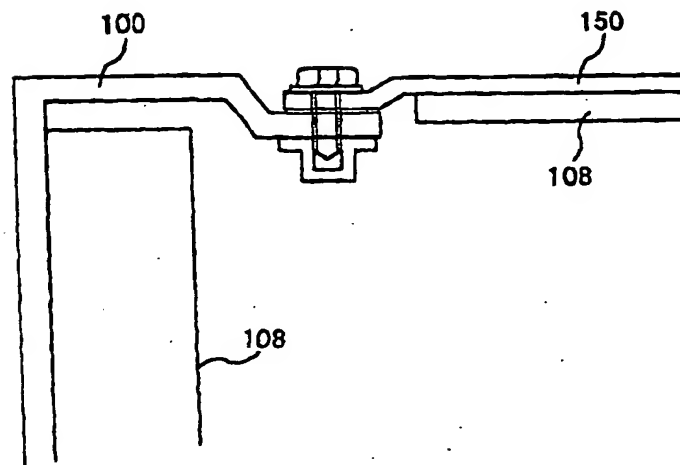


Fig. 21

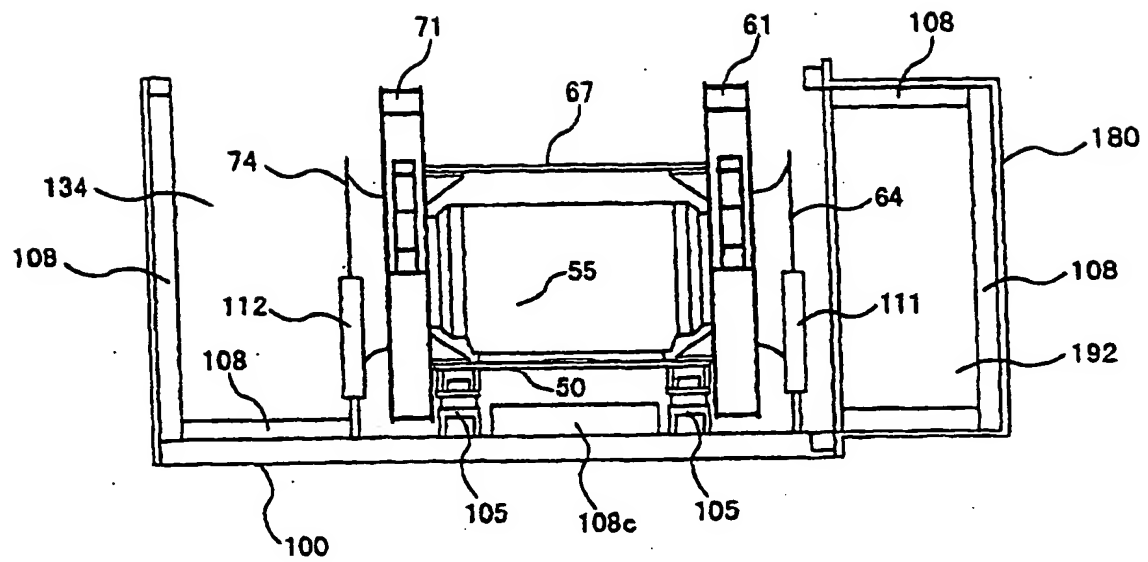


Fig. 22

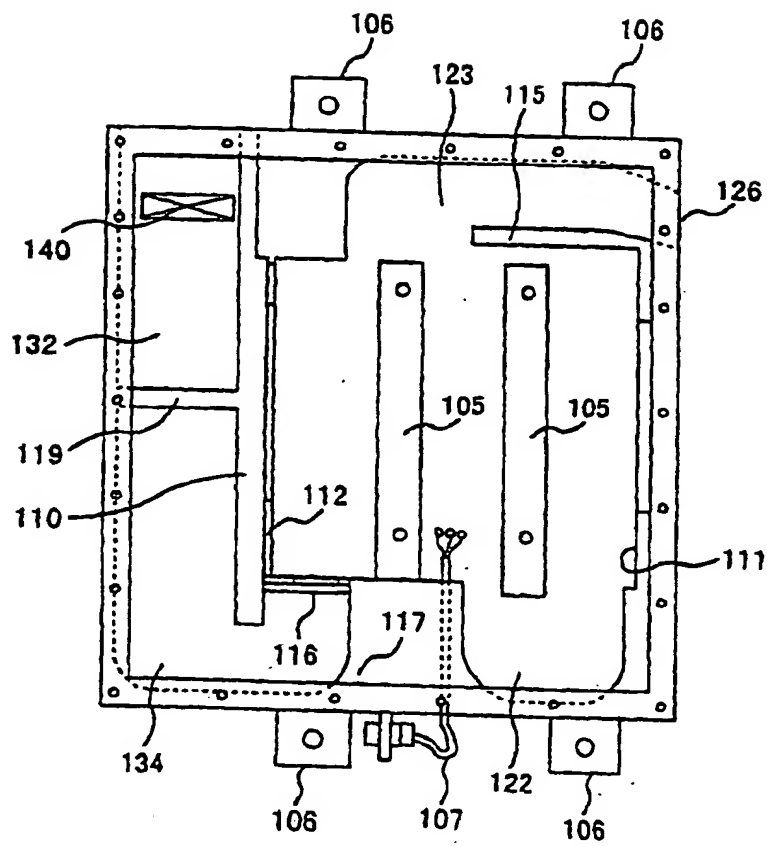


Fig. 23

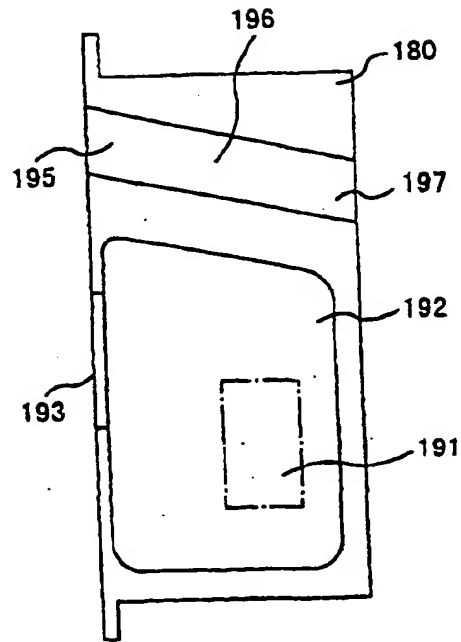


Fig. 24

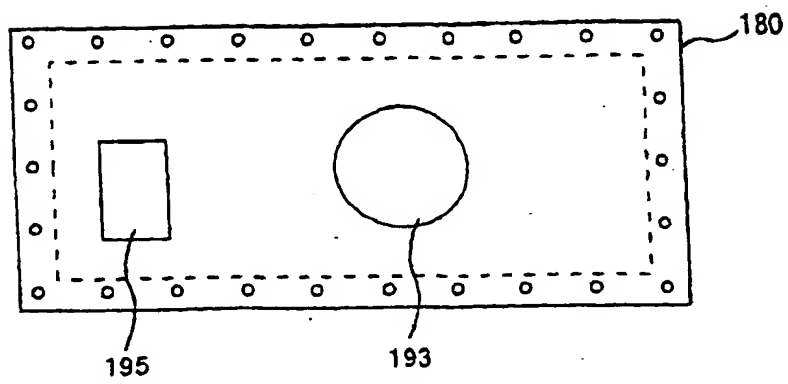


Fig. 25

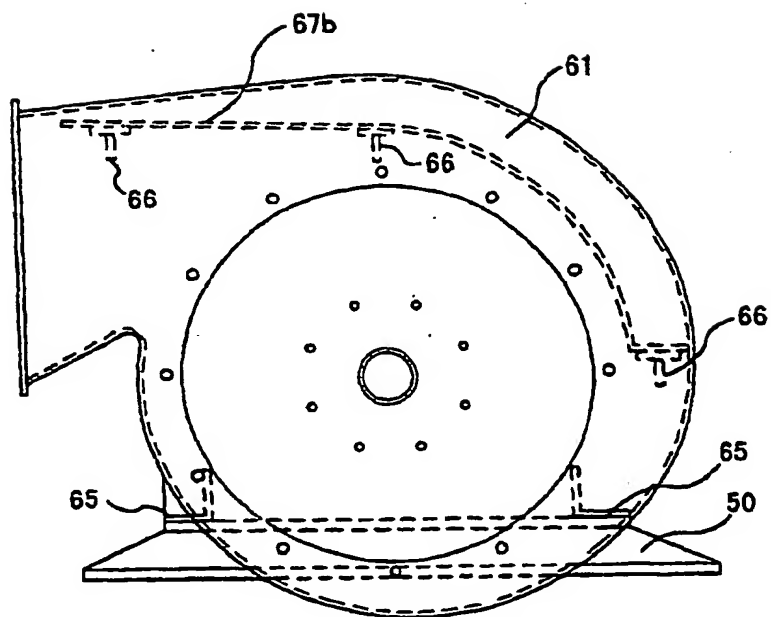
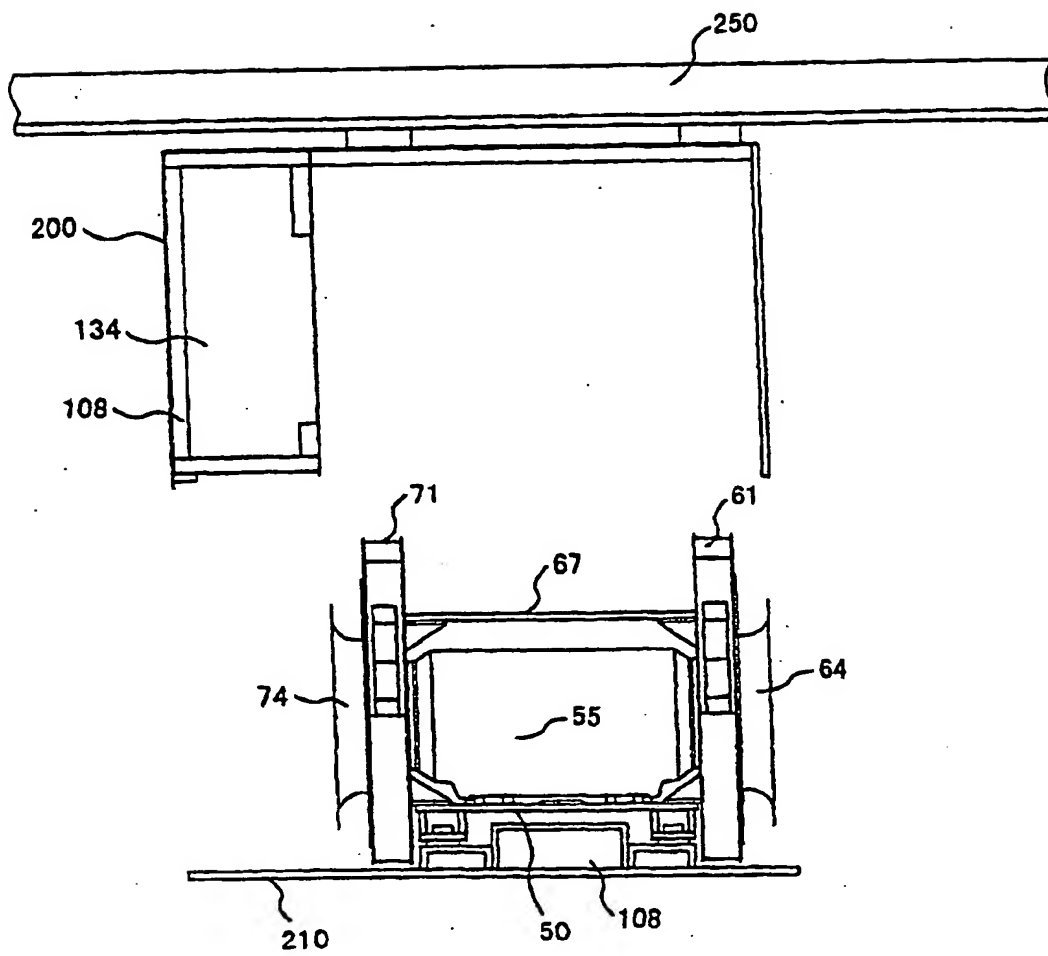


Fig. 26



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP00/00099

A. CLASSIFICATION OF SUBJECT MATTER  
Int.Cl.<sup>7</sup> F04D29/62

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
Int.Cl.<sup>7</sup> F04D29/60-29/64Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
Jitsuyo Shinan Koho 1923-1999  
Kokai Jitsuyo Shinan Koho 1971-1994

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP, 1-36039, Y (Mitsubishi Electric Corporation), 02 November, 1989 (02.11.89), Claim of Japanese Utility Model; page 1, column 1, line 11 to column 2, line 24; page 2, column 3, lines 28-32; drawings (Family: none)	1, 4, 7, 10, 11, 14, 16-18
Y	JP, 1-36039, Y (Mitsubishi Electric Corporation), 02 November, 1989 (02.11.89), Claim of Japanese Utility Model; page 1, column 1, line 11 to column 2, line 24; page 2, column 3, lines 28-32; drawings (Family: none)	2, 3, 5, 6, 8, 9, 12 13, 15, 19-25
Y	JP, 57-154195, Y (MEIDENSHA CORPORATION), 28 September, 1982 (28.09.82), Claim of Japanese Utility Model; drawings (Family: none)	2, 12
Y	JP, 3-41117, Y (Daikin Industries, Ltd.), 29 August, 1991 (29.08.91), Claims of Japanese Utility Model; page 3, column 5, line 36 to column 6, page 6; drawings (Family: none)	3, 13

☒ Further documents are listed in the continuation of Box C.☐ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not  
considered to be of particular relevance"E" earlier document but published on or after the international filing  
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understand the principle or theory underlying the invention"X" document of particular relevance; the claimed invention cannot be  
considered novel or cannot be considered to involve an inventive  
step when the document is taken alone"Y" document of particular relevance; the claimed invention cannot be  
considered to involve an inventive step when the document is  
combined with one or more other such documents, such  
combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search  
18 April, 2000 (18.04.00)Date of mailing of the international search report  
25 April, 2000 (25.04.00)Name and mailing address of the ISA/  
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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP00/00099

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP, 3-50920, B (Matsushita Electric Ind. Co., Ltd.), 05 August, 1991 (05.08.91), Claims; drawings (Family: none)	5, 15
Y	JP, 47-41040, A (Matsushita Seiko Co., Ltd.), 12 December, 1972 (12.12.72), Full text; drawings (Family: none)	6, 9, 20, 21, 23-25
Y	JP, 54-10722, B (Hitachi, Ltd.), 09 May, 1979 (09.05.79), Claims; drawings (Family: none)	19, 23-25
Y	JP, 58-27332, Y (Mitsubishi Electric Corporation), 14 June, 1983 (14.06.83), page 1, column 1, line 33 to column 2, line 5; drawings (Family: none)	19
Y	JP, 3-96420, A (Matsushita Electric Ind. Co., Ltd., et al.), 22 April, 1991 (22.04.91), page 1, lower left column, line 20 to lower right column, line 16; drawings (Family: none)	21, 22
Y	JP, 59-195195, U (Mitsubishi Heavy Industries, Ltd., et al.), 25 December, 1984 (25.12.84), Claim of Japanese Utility Model; drawings (Family: none)	24

Form PCT/ISA/210 (continuation of second sheet) (July 1992)